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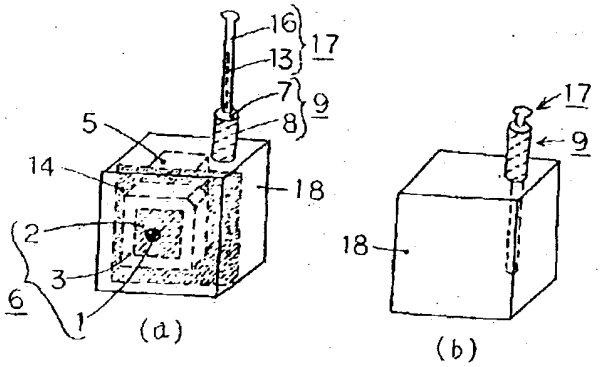
(54)【発明の名称】　複合アンテナ装置

(57)【要約】

【課題】従来、携帯電話等の移動体通信の衛星通信と地上通信の両方の基地局と通信可能な複合アンテナは受信感度を損なう配置になっていた。

【解決手段】円偏波用の平面アンテナ６と直線偏波用のヘリカルアンテナ９と半波長アンテナ１７と逆Ｆ形アンテナ５からなる複合アンテナで、複合アンテナを衛星通信か地上通信かの状況によりアンテナの姿勢を変化させる。



【特許請求の範囲】
【請求項１】円偏波用平面アンテナと、直線偏波用平面アンテナと、前記両平面アンテナが接地部を共用する接地導体板と、前記接地導体板を挟んで両平面アンテナを配置し無線機頭部で回動するアンテナ収納手段とが具備されたことを特徴とする複合アンテナ装置。
【請求項２】前記アンテナ収納手段あるいはこれとは別体に無線機本体側にヘリカルアンテナと、引き出された時、前記ヘリカルアンテナに容量的に結合され、かつ収納された時、前記結合が実質的に解除されるよう適合された伸長可能な半波長アンテナとから成る直線偏波用伸縮アンテナが配置され、前記円偏波用平面アンテナは動作周波数がｆ１、前記直線偏波用の平面アンテナと伸縮アンテナとは動作周波数がｆ２であって、衛星通信時に前記円偏波用平面アンテナに切り換わり、地上通信時に前記直線偏波用の平面アンテナと伸縮アンテナとを切り換える少なくとも２個の切り換え手段を具備することを特徴とする請求項１記載の複合アンテナ装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】図６（ａ）（ｂ）のように、本発明は、携帯用無線機２０を用いて衛星３２との衛星通信３４を行う移動体通信と地上の基地局３３との地上通信３５を行う移動体通信の両システムに有効なアンテナの配置に関するものである。
【０００２】
【従来の技術】現在、携帯用無線機（２０）（以下、携帯電話）などの移動体通信においては、８００ＭＨｚ帯、１．５ＧＨｚ帯、１．９ＧＨｚ帯の直線偏波が用いられている。近年、衛星（３２）を用いた携帯電話（２０）の構想が各社から提案されており、それらの周波数帯は、地上の携帯電話（２０）から衛星（３２）へは１．６ＧＨｚ帯が、衛星（３２）から地上の携帯電話（２０）へは２．４ＧＨｚ帯が割当てられているもの、また１．６ＧＨｚ帯は地上から衛星（３２）、衛星（３２）から地上の双方向の通信に用いる周波数帯として割当てられているものがある。アンテナ構成として、例えば図７に示すものは、衛星通信（３４）には送信用マイクロストリップライン平面アンテナ２２（以下、送信用平面アンテナ）と受信用マイクロストリップライン平面アンテナ２３（以下、受信用平面アンテナ）を用い、地上の基地局（３３）に対しては、直線偏波用の線状アンテナ２１に切り換えて用いる方法（ＩＴＵ研究　世界の非静止衛星通信システム　Ｎｏ．２６１／２６２　新日本ＩＴＵ協会　１９９３年８月刊行　Ｐ．３６）が提案されている。
【０００３】以下、図７により従来技術を説明する。ここでは、説明のため上記ＩＴＵ研究に掲載されているオッデッセイシステム（米国　ＴＲＷ社）で提案されている線状アンテナ２１と平面アンテナ２２、２３での構成に沿って述べる。このアンテナ系は、線状アンテナ２１と送信用平面アンテナ２２と受信用平面アンテナ２３とを一体的に備えた折りたたみアンテナアレイ２４で、携帯電話２０の頭部を中心に背面側に回転し、感度を良好になる任意の角度に固定できる。線状アンテナは周波数ｆ２で地上通信（３５）に用いる。送信用平面アンテナ２２と受信用平面アンテナ２３はそれぞれ周波数ｆ１，ｆ３を用い衛星（３２）と衛星通信（３４）を行う。送信・受信の帯域が同じ周波数ｆ１の衛星通信システムの場合は、前記平面アンテナのうち一方を送信と受信に兼用すればよい。
【０００４】
【発明が解決しようとする課題】しかしながら、この折りたたみアンテナアレイ２４は、折りたたんだ状態での通信感度や地上通信に対する考慮がなされておらず、折りたたんだ状態での通信感度や地上通信時に動作するアンテナが１つしかなく通信感度の劣化が生じる。
【０００５】
【課題を解決するための手段】本発明は上述の課題を解決するため、円偏波用平面アンテナと、直線偏波用平面アンテナと、前記両平面アンテナが接地部を共用する接地導体板と、前記接地導体板を挟んで両平面アンテナを配置し無線機頭部で回動するアンテナ収納手段とが具備されるものである。
【０００６】
【発明の実施の形態】図１～図６は本発明の実施の形態を示す。図において同じ部位は同じ符号で示す。図１に示す５は逆Ｆ形アンテナ（直線偏波用の平面アンテナ手段）、６は背面給電方式のマイクロストリップライン平面アンテナ（円偏波用の平面アンテナ手段）、９はヘリカルアンテナ、１７は半波長アンテナ、１８は複合アンテナの収納手段である。
【０００７】本発明の実施形態は、図１のように誘電体の基板３の一方の面にパッチ状の導体２と他方の面に地導体板４と少なくとも１本の給電ピン１を備える背面給電方式のマイクロストリップライン平面アンテナ６（以下、平面アンテナ）と、逆Ｆ形アンテナ５と、この平面アンテナ６と逆Ｆ形アンテナ５の接地部を共用する接地導体１４と、誘電体円筒７に巻かれた螺旋状の導体線８から成るヘリカルアンテナ９と、引き出された時、ヘリカルアンテナ９に容量的に結合され、かつ収納された時、これから実質的に減結合されるように適合された伸長可能な半波長アンテナ１７とで複合アンテナを構成する。更に図２のように、この複合アンテナの収納手段１８を回動させる複合アンテナの支持体１９とを組み合わせて携帯電話２０の頭部で回動するアンテナ装置を構成する。
【０００８】ここでは、各々の素子の動作を説明し、さらにそれらの複合アンテナとしての配置、最後に複合アンテナ装置としての動作について説明する。

【０００９】まず最初に、平面アンテナ６が図６（ｂ）に示す衛星通信３４に用いる円偏波アンテナとして動作する場合について説明する。平面アンテナ６は、図４に示すように、誘電体の基板３にパッチ状の導体２と、他方の面に地導体板４と、給電ピン用の貫通孔１５を設け、誘電体の基板３の誘電率、基板３に貼付するパッチ状の導体２の寸法、給電ピン用の貫通孔１５の位置等を適切に設計することにより、円偏波アンテナとして動作する。他方の面に設けられた地導体板４は貫通孔１５より大きな径に孔が開けられ、貫通孔１５に給電ピン１を設けるとパッチ状の導体２に接続し、地導体板４には非接触である。例えば図のように平面アンテナ６に四角形パッチアンテナを設けた場合、使用する周波数帯に応じて平面アンテナ６は１点給電方式のパッチアンテナで長い方の辺と短い方の辺をそれぞれＡ，Ｂとすると１００×Ａ／Ｂ＝１０２～１０３％程度になるように構成する。給電ピン用の貫通孔１５は四角形のパッチ状の導体２の略対角線上に配置する。このとき、長い方の辺Ａでは低い周波数で共振し直線偏波特性を示し、短い方の辺Ｂでは高い周波数で共振し前記楕円偏波と交差した直線偏波特性を示し、それらの間の周波数で円偏波アンテナとして動作する。

【００１０】さらに、図４（ｂ）のように給電ピン用の貫通孔１５を四角形の対角線上に１００×（ａ－ｂ）／ａ＝３０％程度になるように配置すれば５０Ω系のインピーダンス整合がとれ、特性インピーダンス５０Ωのインピーダンス整合がとれることが知られている。また誘電体の基板３の厚さ等により帯域幅を設定する。

【００１１】次に、平面アンテナ６の地導体板４と接地導体１４の一方の面を電気的に接続し、接地導体１４の他方の面に図６（ａ）に示す地上通信３５のダイバーシチに用いる逆Ｆ形アンテナ５（図５参照）を電気的に接続する。

【００１２】その次に、ヘリカルアンテナ９は、導体線を誘電体円筒７に巻き、半波長アンテナ１７を収納した状態と伸長した状態において、使用する地上通信３５での周波数ｆ２で動作するように、ヘリカルアンテナの巻き数や誘電体円筒７の直径を適切に設定する。

【００１３】さらに、ヘリカルアンテナ９と同一の周波数帯で動作する半波長アンテナ１７はヘリカルアンテナ９の略中心を通り収納及び伸長自在で引き出し時にヘリカルアンテナ９と容量的に結合し、収納時に減結合されるように、線状の導線またはヘリカルアンテナ９の直径以下の直径の導体線または小径巻きのヘリカルアンテナで構成する。

【００１４】以上の４つのアンテナ群を１つの収納手段１８に収納し、収納手段１８を携帯電話２０の上端部に配置し、可動させるための支持体１９を設ける。以上により衛星通信３４をする際には平面アンテナ６が天頂方向を向くようにし、地上通信３５をする際には逆Ｆ形アンテナ５が携帯電話２０の背面になるように可動させる。このように複合アンテナを配置することにより衛星通信３４においても、地上通信３５においても通信感度を確保することが可能となる。

【００１５】本発明の実施形態では４つのアンテナ群を１つの収納手段１８に収納したが、２つの収納手段を設け、一方には平面アンテナ６と逆Ｆ形アンテナ５を収納し、他方にヘリカルアンテナ９と半波長アンテナ１７を設けて、適宜、両方の収納手段または平面アンテナ６の収納手段側のみを可動させても何ら差し支えない。

【００１６】図３により本発明の実施形態における動作状況を説明する。

【００１７】図３において２７は地上通信のダイバーシチに使用する第１の切り換え手段、２８は地上通信と衛星通信の切り換えに使用する第２の切り換え手段、Ｄは半波長アンテナ１７とヘリカルアンテナ９との間隔であり、半波長アンテナ１７を伸長したときに前記２つのアンテナは間隔Ｄで容量的に結合し、収納したときには減結合する。点線は各アンテナと携帯電話２０の本体に接続するための同軸線である。また、図６（ａ）（ｂ）に示すようにｆ１は衛星通信３４の周波数、ｆ２は地上通信の周波数である。平面アンテナ６と逆Ｆ形アンテナ５は接地導体１４によって隔てられる。

【００１８】

【発明の効果】以上説明したように本発明によれば、携帯電話２０のような小型な携帯用無線機を用いて送信、受信の通信感度を衛星通信３４、地上通信３５の如何を問わず保つことが可能となる。

【図面の簡単な説明】

【図１】　本発明の実施形態を示し（ａ）は半波長アンテナ伸長時、（ｂ）は半波長アンテナ収納時の図。

【図２】　本発明の実施形態を示す複合アンテナ装置を搭載した携帯電話の斜視図で、（ａ）は地上通信時の斜視図、（ｂ）は衛星通信時の斜視図。

【図３】　本発明の実施形態における動作切替え説明する図で、（ａ）は斜視図、（ｂ）は正面図。

【図４】　マイクロストリップライン平面アンテナの説明図。

【図５】　逆Ｆ形アンテナの説明図。

【図６】　移動体通信の説明図。

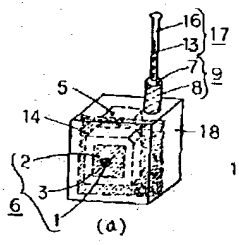
【図７】　従来例の携帯電話の斜視図。

【符号の説明】

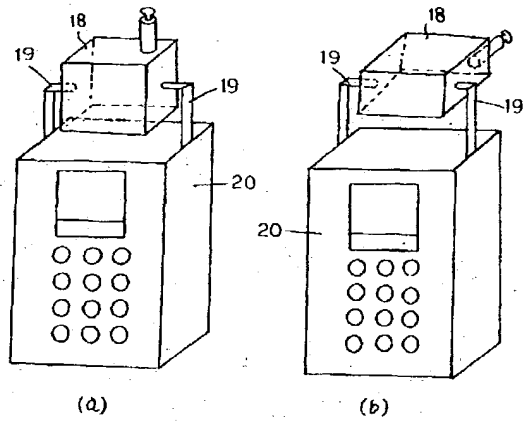
１：給電ピン
２：パッチ状の導体
３：誘電体（誘電体の基板）
４：地導体板
５：逆Ｆ形アンテナ（直線偏波用の平面アンテナ手段）
６：マイクロストリップライン平面アンテナ（円偏波用の平面アンテナ手段）
７：誘電体円筒

８：螺旋状の導体線
９：ヘリカルアンテナ
１０：逆Ｆ形アンテナの給電点
１１：ヘリカルアンテナの給電点
１２：平面アンテナの給電点
１３：半波長アンテナの導体線
１４：接地導体
１５：平面アンテナの給電ピン用の貫通孔
１６：半波長アンテナの保護誘電体
１７：半波長アンテナ
１８：複合アンテナの収納手段
１９：複合アンテナの支持手段
２０：携帯用無線機（携帯電話）
２１：線状アンテナ
２２：送信用マイクロストリップ平面アンテナ（送信用平面アンテナ）
２３：受信用マイクロストリップ平面アンテナ（受信用平面アンテナ）
２４：折りたたみアンテナアレイ
２７：第１の切り換え手段
２８：第２の切り換え手段
３２：衛星
３３：地上の基地局
３４：衛星通信
３５：地上通信

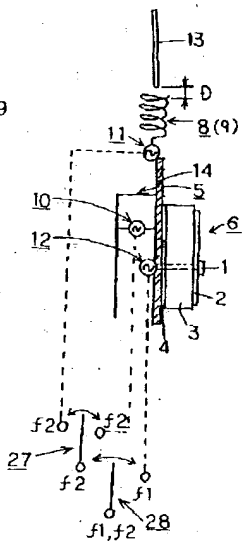
【図１】



【図２】



【図３】



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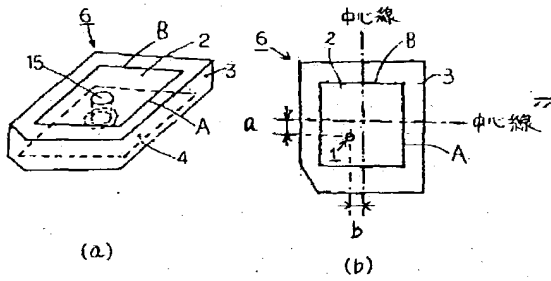
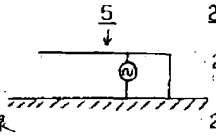
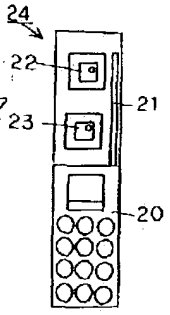


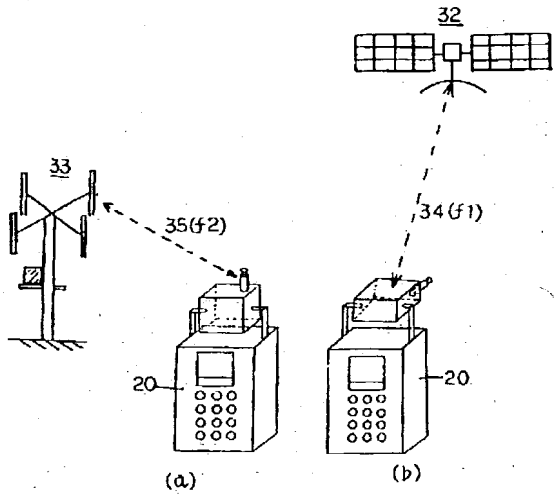
【図５】



【図７】



【図６】



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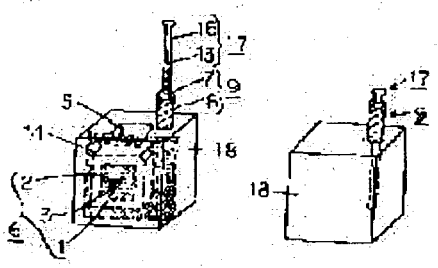
(22)Date of filing : 11.10.1995

(71)Applicant : KYOCERA CORP
(72)Inventor : SUGURO AKIHIRO
NAKADA SHINICHI

(54) COMPOSITE ANTENNA EQUIPMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To keep the communication sensitivity in satellite communication as well as ground communication by arranging a plane antenna for circularly polarized wave and a plane antenna for linearly polarized wave between which an earth conductor plate is interposed and providing an antenna storage means turned by a radio machine head part.
SOLUTION: A composite antenna consists of a micro strip line plane antenna 6 in the back feed system, an inverted F type antenna 5, an earth conductor 14 sharing the earth part of the plane antenna 6 and the inverted F type antenna 5, a helical antenna 9, and a half-wave antenna 17. It is stored in a storage means 18, and the storage means 18 is arranged on the upper end part of a portable telephone, and a support body to move it is provided. In the case of satellite communication, the antenna is moved so that the plane antenna 6 is turned to the zenith; and in the case of ground communication, it is so moved that the inverted F type antenna 5 is placed at the rear of the portable telephone. Since the composite antenna is arranged in this manner, the communication sensitivity is secured in satellite communication as well as ground communication.



LEGAL STATUS

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] grounding whose flat antenna for circularly-polarized waves, flat antenna for linearly polarized waves, and both aforementioned flat antennas share the grounding section -- a conductor -- a board and the aforementioned grounding -- a conductor -- the compound antenna equipment characterized by what an antenna receipt means to have arranged both flat antennas on both sides of a board, and to rotate in a walkie-talkie head possessed
[Claim 2] Compound antenna equipment according to claim 1 characterized by providing the following. The aforementioned antenna receipt means or this is a helical antenna to the main part side of a walkie-talkie in another object. When are pulled out, and it is combined with the aforementioned helical antenna in capacity and contained, The flexible antenna for linearly polarized waves which consists of the half-wave antenna which suited so that the aforementioned combination might be canceled substantially, and which can be elongated is arranged. The frequency of operation of the flat antenna and flexible antenna of the for [flat antenna / for circularly-polarized waves / aforementioned] f1 and for the aforementioned linearly polarized waves in a frequency of operation is f2. At least two switch meanses which switch to the aforementioned flat antenna for circularly-polarized waves, and switch the flat antenna and flexible antenna for the aforementioned linearly polarized waves at the time of ground communication at the time of satellite communication.

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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] As shown in drawing 6 (a) and (b), this invention relates to arrangement of an antenna effective in both the systems of the mobile communications which perform ground communication 35 with the mobile communications which perform satellite communication 34 with a satellite 32 using the portable walkie-talkie 20, and the terrestrial base station 33.
[0002]
[Description of the Prior Art] Now, in mobile communications, such as a portable walkie-talkie (20) (the following, cellular phone), the linearly polarized wave of a 800MHz band, a 1.5GHz band, and a 1.9GHz band is used. The design for the cellular phone (20) using the satellite (32) is proposed from each company in recent years. those frequency bands That by which the 2.4GHz band is assigned to the satellite (32) from the satellite (32) from the terrestrial cellular phone (20) to the cellular phone (20) of the ground [band / 1.6GHz], Moreover, a 1.6GHz band has some which are assigned from the ground as a frequency band used for terrestrial bidirectional communication from a satellite (32) and a satellite (32). As antenna composition, for example, the thing shown in drawing 7 To satellite communication (34), the microstrip-line flat antenna 22 for transmission A terrestrial base station (33) is received using (the flat antenna for the following and transmission), and the microstrip-line flat antenna 23 (flat antenna for the following and reception) for reception. the line for linearly polarized waves -- the method (the non-geostationary satellite in the ITU research world communication system No.261 / 262 New ITU Association of Japan August, 1993 publication P.36) of switching and using for an antenna 21 is proposed
[0003] Hereafter, drawing 7 explains the conventional technology. the line proposed here by ODDESSEISHISUTEMU (U.S. TRW, Inc.) carried by the above-mentioned ITU research for explanation -- it states along with the composition in an antenna 21 and flat antennas 22 and 23 this antenna system -- a line -- it folds up, and it is an antenna array 24, and it rotates to a tooth-back side focusing on the head of a cellular phone 20, and sensitivity can be fixed to the arbitrary angles which were equipped with the antenna 21, the flat antenna 22 for transmission, and the flat antenna 23 for reception in one and which become good a line -- an antenna is used for ground communication (35) on frequency f2 The flat antenna 22 for transmission and the flat antenna 23 for reception perform a satellite (32) and satellite communication (34) using frequency f1 and f3, respectively. What is necessary is just to use one side also [reception / transmission and] among the aforementioned flat antennas, when the band of transmission and reception is the satellite communication system of the same frequency f1.
[0004]
[Problem(s) to be Solved by the Invention] However, the consideration to the communication sensitivity in the state where it folded up, or ground communication is not made, but there is only one antenna which operates at the time of the communication sensitivity in the state where it folded up, or ground communication, and degradation of communication sensitivity produces this folding antenna array 24.

[0005]
[Means for Solving the Problem] grounding whose flat antenna for circularly-polarized waves, flat antenna for linearly polarized waves, and both aforementioned flat antennas share the grounding section in order that this invention may solve an above-mentioned technical problem -- a conductor -- a board and the aforementioned grounding -- a conductor -- an antenna receipt means to arrange both flat antennas on both sides of a board, and to rotate in a walkie-talkie head possesses
[0006]
[Embodiments of the Invention] Drawing 1 - drawing 6 show the gestalt of operation of this invention. In drawing, the same sign shows the same part. For a reverse F type antenna (flat antenna means for linearly polarized waves), and 6, as for a helical antenna and 17, the microstrip-line flat antenna (flat antenna means for circularly-polarized waves) of a tooth-back electric supply method and 9 are [5 shown in drawing 1 / a half-wave antenna and 18] the receipt meanses of a compound antenna.
[0007] the operation gestalt of this invention -- drawing 1 -- like -- one field of the substrate 3 of a dielectric -- the patch-like conductor 2 and the field of another side -- the ground -- a conductor -- a tooth-back electric supply method equipped with a board 4 and at least one electric supply pin 1 microstrip-line flat antenna 6 grounding which shares the grounding section of (the following, a flat antenna), the reverse F type antenna 5, and the this flat antenna 6 and the reverse F type antenna 5 -- with a conductor 14 the spiral conductor wound around the dielectric cylinder 7 -- a compound antenna consists of half-wave antennas 17 which suited so that it might be substantially decoupled with the helical antenna 9 which consists of a line 8 after this, when it is combined by the helical antenna 9 in capacity when pulled out, and contained and which can be elongated Furthermore, the antenna equipment which rotates in the head of a cellular phone 20 like drawing 2 combining the base material 19 of a compound antenna which rotates the receipt means 18 of this compound antenna is constituted.
[0008] Here, operation of each element is explained and operation as compound antenna equipment is further explained to the arrangement as those compound antennas, and the last.
[0009] The case where it operates as a circularly-polarized-wave antenna which a flat antenna 6 uses for the satellite communication 34 shown in drawing 6 (b) first is explained. a flat antenna 6 is shown in drawing 4 -- as -- the substrate 3 of a dielectric -- the patch-like conductor 2 and the field of another side -- the ground -- a conductor -- it operates as a circularly-polarized-wave antenna by forming a board 4 and the breakthrough 15 for electric supply pins, and designing appropriately the position of the dielectric constant of the substrate 3 of a dielectric, the size of the conductor 2 of the shape of a patch stuck on a substrate 3, and the breakthrough 15 for electric supply pins etc. the ground established in the field of another side -- a conductor -- if a hole can open a board 4 in a bigger path than a breakthrough 15 and the electric supply pin 1 is formed in a breakthrough 15 -- the patch-like conductor 2 -- connecting -- the ground -- a conductor -- it is non-contact at a board 4 For example, as shown in drawing, when a square patch antenna is formed in a flat antenna 6, if a flat antenna 6 sets the side of the longer one, and the side of the shorter one to A and B with the patch antenna of an one-point electric supply method according to the frequency band to be used, respectively, it constitutes so that it may become about 100xA/B=102-103%. The breakthrough 15 for electric supply pins is arranged on the abbreviation diagonal line of the conductor 2 of the shape of a square patch. At this time, it resonates on low frequency and a linearly-polarized-wave property is shown, and in the side B of the shorter one, the linearly-polarized-wave property which resonated on high frequency and intersected the aforementioned elliptically polarized wave is shown, and it operates as a circularly-polarized-wave antenna on the frequency between them in the side A of the longer one.
[0010] Furthermore, it is known that the impedance matching of 50-ohm system can be taken if the breakthrough 15 for electric supply pins is arranged like drawing 4 (b) so that it may become 100x (a-b) / about a= 30% on the square diagonal line, and the impedance matching which is the characteristic impedance of 50ohms can be taken. Moreover, bandwidth is set up with the thickness of the substrate 3 of a dielectric etc.

[0011] next, the ground of a flat antenna 6 -- a conductor -- a board 4 and grounding -- one field of a conductor 14 -- electric -- connecting -- grounding -- the reverse F type antenna 5 (refer to drawing 5) used for the diversity of the ground communication 35 shown in the field of another side of a conductor 14 at drawing 6 (a) is connected electrically
[0012] the degree -- a helical antenna 9 -- a conductor -- a line is coiled around the dielectric cylinder 7, and in the state where it elongated with the state where the half-wave antenna 17 was contained, the number of turns of a helical antenna and the diameter of the dielectric cylinder 7 are appropriately set up so that it may operate on the frequency f2 in the ground communication 35 to be used
[0013] furthermore, the half-wave antenna 17 which operates by the same frequency band as a helical antenna 9 -- the abbreviation center of a helical antenna 9 -- a passage -- receipt and extension -- free -- the time of a drawer -- a helical antenna 9 and capacity ---like -- joining together -- the time of receipt -- decoupling -- having -- as -- the conductor of the diameter below a linear lead wire or the diameter of a helical antenna 9 -- it constitutes from a helical antenna of a line or a minor diameter volume
[0014] The above four antenna groups are contained for one receipt means 18, and the base material 19 for arranging and carrying out movable [of the receipt means 18] to the upper-limit section of a cellular phone 20 is formed. In case satellite communication 34 is carried out by the above, it is made for a flat antenna 6 to turn to the direction of a zenith, and in case ground communication 35 is carried out, it carries out movable so that the reverse F type antenna 5 may become the tooth back of a cellular phone 20. Thus, also in satellite communication 34, it becomes possible by arranging a compound antenna to secure communication sensitivity also in the ground communication 35.
[0015] Although four antenna groups were contained for one receipt means 18 with the operation gestalt of this invention, two receipt meanses are established, to one side, a flat antenna 6 and the reverse F type antenna 5 are contained, and a helical antenna 9 and a half-wave antenna 17 are formed in another side, and even if it carries out movable [only of receipt meanses / both / side or the receipt means side of a flat antenna 6], it does not interfere at all suitably.
[0016] Drawing 3 explains the situation of operation in the operation gestalt of this invention.
[0017] The 1st switch means which uses 27 for the diversity of ground communication in drawing 3 , the 2nd switch means which uses 28 for a switch of ground communication and satellite communication, and D are the intervals of a half-wave antenna 17 and a helical antenna 9, and when the two aforementioned antennas are combined in capacity at intervals of D when a half-wave antenna 17 is elongated, and it contains, they are decoupled. A dotted line is a coaxial line for connecting with the main part of each antenna and a cellular phone 20. Moreover, as shown in drawing 6 (a) and (b), f1 is the frequency of satellite communication 34, and f2 is the of ground communication. a flat antenna 6 and the reverse F type antenna 5 -- grounding -- it is separated by the conductor 14
[0018]
[Effect of the Invention] As explained above, according to this invention, it becomes possible to maintain the communication sensitivity of transmission and reception regardless of how of satellite communication 34 and the ground communication 35 using a small portable walkie-talkie like a cellular phone 20.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The operation gestalt of this invention is shown and, for (a), (b) is drawing at the time of half-wave antenna receipt at the time of half-wave antenna extension.
[Drawing 2] At the perspective diagram of a cellular phone which carried the compound antenna equipment in which the operation gestalt of this invention is shown, (a) is a perspective diagram at the time of ground communication, and (b) is a perspective diagram at the time of satellite communication.
[Drawing 3] In drawing in the operation gestalt of this invention which gives change explanation of operation, (a) is a perspective diagram and (b) is front view.
[Drawing 4] Explanatory drawing of a microstrip-line flat antenna.
[Drawing 5] Explanatory drawing of a reverse F type antenna.
[Drawing 6] Explanatory drawing of mobile communications.
[Drawing 7] The perspective diagram of the cellular phone of the conventional example.
[Description of Notations]
1: Electric supply pin
2: Patch-like conductor
3: Dielectric (substrate of a dielectric)
4: the ground -- a conductor -- a board
5: Reverse F type antenna (flat antenna means for linearly polarized waves)
6: Microstrip-line flat antenna (flat antenna means for circularly-polarized waves)
7: Dielectric cylinder
8: a spiral conductor -- a line
9: Helical antenna
10: The feeding point of a reverse F type antenna
11: The feeding point of a helical antenna
12: The feeding point of a flat antenna
13: the conductor of a half-wave antenna -- a line
14: grounding -- a conductor
15: The breakthrough for the electric supply pins of a flat antenna
16: The protection dielectric of a half-wave antenna
17: Half-wave antenna
18: The receipt means of a compound antenna
19: Support means of a compound antenna
20: A portable walkie-talkie (cellular phone)
21: a line -- an antenna
22: The micro-stripe flat antenna for transmission (flat antenna for transmission)
23: The micro-stripe flat antenna for reception (flat antenna for reception)
24: Folding antenna array
27: The 1st switch means
28: The 2nd switch means
32: Satellite

33: A terrestrial base station
34: Satellite communication
35: Ground communication

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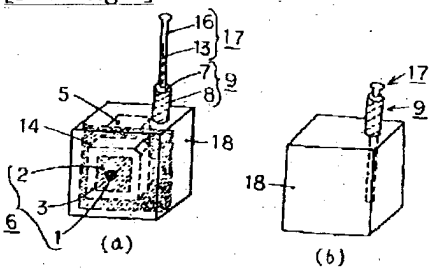
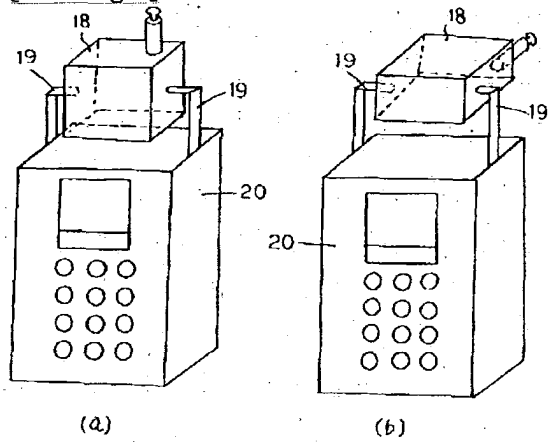
DRAWINGS

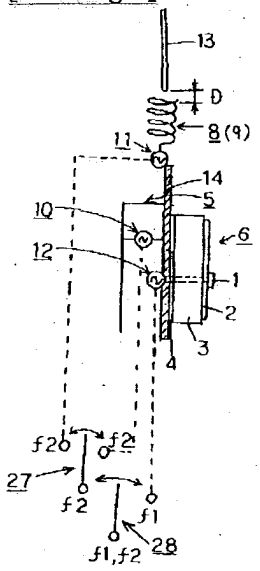
[Drawing 1]



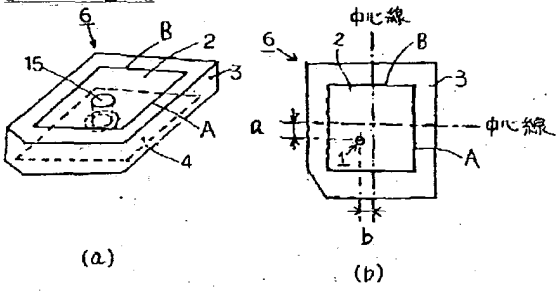
[Drawing 2]



[Drawing 3]



[Drawing 4]



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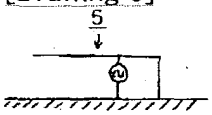

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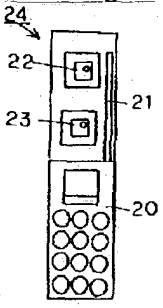
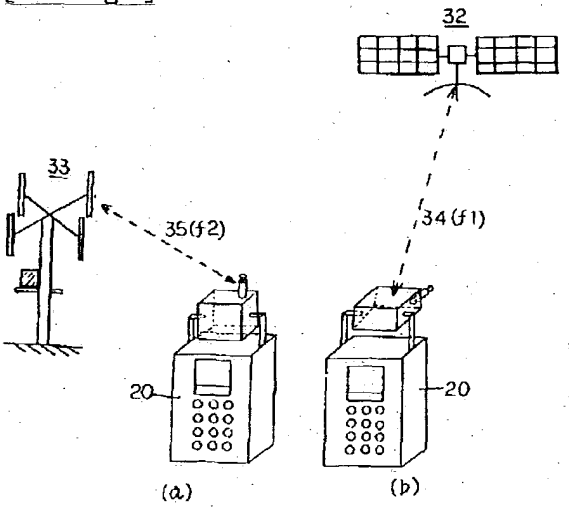


[Drawing 6]



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